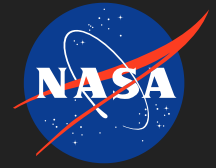


Advanced Manufacturing of Intermediate Temperature, Direct Methane Oxidation Membrane Electrode Assemblies for Durable Solid Oxide Fuel Cell, Phase II

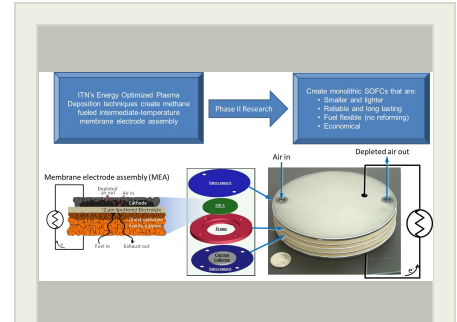
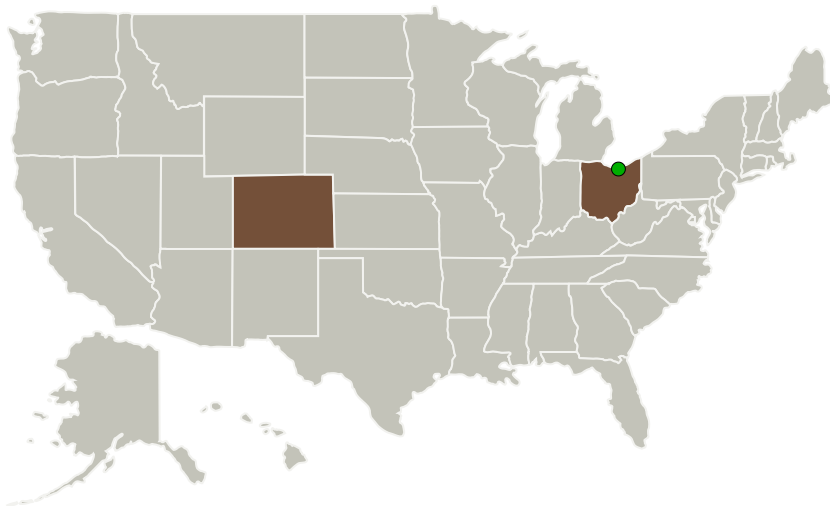
Completed Technology Project (2014 - 2016)



Project Introduction

The proposed innovation builds on the successes of the Phase I program by integrating our direct oxidation membrane electrode assembly (MEA) into a monolithic solid oxide fuel cell stack (SOFC) capable of long-term operation on methane or syngas. This innovation is significant because it will contribute to durable, cycle-able simple SOFC systems to meet the needs for NASA and commercial customers. ITN's Phase II strategy addresses the technical hurdles that limit the long-term durability and thermal cycling of state-of-the-art SOFCs operating on methane fuel, including • Matching stack components for coefficient of thermal expansion • Reducing stack mass • Stack sealing • Reducing anode degradation, and • Reducing operating temperatures. With this innovation, we project that the proposed SOFC stack will be capable of operating without degradation for more than the targeted 2500 hours and will operate without power density degradation after 50 start-up and shut-down cycles. By utilizing the direct-oxidation membrane electrode assemblies developed in the phase I program, the thermodynamic efficiencies from fuel source to DC output should exceed 70%. Higher efficiencies translate to lower cooling requirement as obtained by way of conduction through the stack to a radiator exposed to space and/or by anode exhaust flow.

Primary U.S. Work Locations and Key Partners



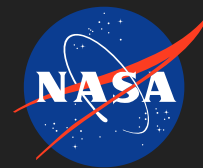
Advanced Manufacturing of Intermediate Temperature, Direct Methane Oxidation Membrane Electrode Assemblies for Durable Solid Oxide Fuel Cell, Phase II Briefing Chart Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Advanced Manufacturing of Intermediate Temperature, Direct Methane Oxidation Membrane Electrode Assemblies for Durable Solid Oxide Fuel Cell, Phase II

Completed Technology Project (2014 - 2016)



Organizations Performing Work	Role	Type	Location
ITN Energy Systems, Inc.	Lead Organization	Industry Minority-Owned Business	Littleton, Colorado
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Colorado	Ohio

Project Transitions

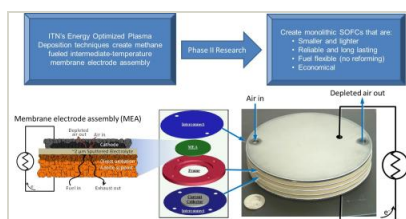
▶ **July 2014:** Project Start

✓ **July 2016:** Closed out

Closeout Documentation:

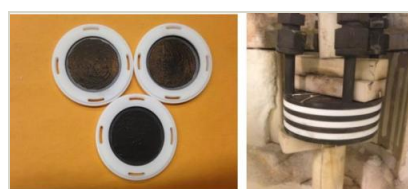
- Final Summary Chart(<https://techport.nasa.gov/file/137443>)

Images



Briefing Chart Image

Advanced Manufacturing of Intermediate Temperature, Direct Methane Oxidation Membrane Electrode Assemblies for Durable Solid Oxide Fuel Cell, Phase II Briefing Chart Image (<https://techport.nasa.gov/image/131190>)



Final Summary Chart Image

Advanced Manufacturing of Intermediate Temperature, Direct Methane Oxidation Membrane Electrode Assemblies for Durable Solid Oxide Fuel Cell, Phase II Project Image (<https://techport.nasa.gov/image/132997>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ITN Energy Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

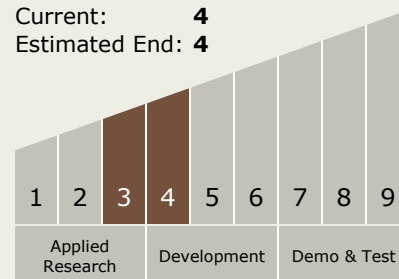
Carlos Torrez

Principal Investigator:

Erick White

Technology Maturity (TRL)

Start: 3
Current: 4
Estimated End: 4



Advanced Manufacturing of Intermediate Temperature, Direct
Methane Oxidation Membrane Electrode Assemblies for Durable
Solid Oxide Fuel Cell, Phase II
Completed Technology Project (2014 - 2016)



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Sun, Earth, The Moon,
Mars, Others Inside the Solar
System, Outside the Solar
System